

1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant: Ningbo BEC Lighting CO.,LTD
Address of applicant: Sanbei Industrial Zone, Longshan Town, Cixi, Ningbo, 315331, P.R.China
Manufacturer: The same as Applicant
Address of manufacturer: The same as Applicant

General Description of EUT:

Product Name: Multifunctional ceiling light
Trade Name: BEC
Model No.: 323136-7
323123-2, 323123-6, 323123-8, 323107-2, 323107-6, 323107-8, 323127-5, 323127-6, 323127-7, 323127-8, 323127-9, 323127-10, 323137-5, 323137-6, 323137-7, 323137-8, 323137-9, 323137-10, 323126-5, 323126-6, 323126-7, 323126-8, 323126-9, 323126-10, 323126-13, 323126-14, 323136-5, 323136-6, 323136-7, 323136-8, 323136-9, 323136-10, 323136-13, 323136-14
Adding Model(s):
Rated Voltage: AC120V/60Hz
Power Adapter: /
FCC ID: 2A9OL-323136-7
Equipment Type: Mobile device

Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model 323136-7, but the circuit and the electronic construction do not change, declared by the manufacturer.

Technical Characteristics of EUT:

Bluetooth(LE mode)

Bluetooth Version: V4.2 (BLE mode)
Frequency Range: 2402-2480MHz
RF Output Power: 5.68dBm (Conducted)
Data Rate: 1Mbps
Modulation: GFSK
Quantity of Channels: 40
Channel Separation: 2MHz
Type of Antenna: PCB Antenna
Antenna Gain: 2.21dBi

Wi-Fi

Support Standards: 802.11b, 802.11g, 802.11n
2412-2462MHz for 802.11b/g/n(HT20)
Frequency Range: 2422-2452MHz for 802.11n(HT40)
RF Output Power: 18.37dBm (Conducted)
Type of Modulation: CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM

Quantity of Channels: 11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
 Channel Separation: 5MHz
 Type of Antenna: PCB Antenna
 Antenna Gain: 2.21dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A): The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R ²
1.34-30	3,450 R ² /f ²
30-300	3.83 R ²
300-1,500	0.0128 R ² f
1,500-100,000	19.2R ²

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).

(B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

1.3 Calculated Result

Radio Access Technology	Min. Frequency	Max. Output Power	Max. Tune-Up Output Power	Antenna Gain	Duty Cycle	Tune-Up EIRP
	(MHz)	(dBm)	(dBm)	(dBi)	(%)	(dBm)
Bluetooth	2402	5.68	6.0	2.21	100	8.21
Wi-Fi	2412	18.37	19.0	2.21	100	21.21

Frequency (MHz)	Option	Min. Distance	Tune-Up ERP		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
2402	C	20.00	6.06	4.04	768.00	0.01	Pass
2412	C	20.00	19.06	80.54	768.00	0.10	Pass

Note: 1. $ERP=EIRP-2.15dB$; $EIRP=Output\ Power + Antenna\ gain$

2. Option A, B and C refers as clause 1.2.

3. For option B, $P_{th}(mW)$ convert to $Exposure\ Limit(mW)$; For option C, $ERP(W)$ convert to $Exposure\ Limit(mW)$.

4. $Ratio=Tune-Up\ ERP(mW)/Exposure\ Limit\ (mW)$

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result
					Pass/Fail
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Note: Wi-Fi and Bluetooth are used the same Antenna, not support simultaneous transmission.

Result: Pass